Annual Distribution and Year to Year Variability of Mean Monthly Flows

Expectation: Historic intra-annual patterns of mean monthly flows with inter-annual variability (coefficient of variation) of mean monthly flows < 1.0.

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Relevant Endpoints:
Restoration - Physical Integrity - Hydrology
Restoration - Physical Integrity - Hydrogeomorphic Processes
Restoration - Physical Integrity - Disturbance
Restoration - System Functional Integrity - Habitat Quality
Restoration - System Functional Integrity - Persistence

Baseline Condition: Baseline conditions were derived from daily discharge at S65, S65C and S65E from 1971 to 1998 and daily discharge at PC33 on Micco Bluff Run in Pool C. S65 is located at the outlet of the Upper Kissimmee Basin and contributes approximately 60% of the flows through the Kissimmee River. S65C is located near the middle of the area to be restored and is the downstream control for the first phase of restoration. The S65E structure is located at the outlet of the Kissimmee River basin, approximately seven miles downstream of the restoration project limits. Data collected from November 1997 to May 1999 at PC33 are representative of existing conditions in sections of river channel that will be affected by the first phase of restoration.

The monthly mean of daily discharge describes average flow for a given month. Data at S65, S65C and S65E show that highest flows occur January through April and in August and September while low flows occur in June, November, and December (Figures 1a). During wet season months of June through October, flows increased along the channelized river due to lower basin tributary inflows. During the dry season, flows are primarily a function of headwater discharges with little difference between upstream and downstream locations.

Discharges at the S65 structures represent flows in the C-38 canal and are significantly different from flow conditions in remnant river channels. Data from PC33 indicate that zero flows occurred 70% of the time from November 1997 to May 1999. Daily river flows (PC33) were less than 5% of the C-38 discharge 83% of the period when PC33 flows exceeded zero.

Inter-annual variation of mean monthly flows (Figure 1b), as described by the coefficient of variation (standard deviation/mean), is large (relative to the historic system) during most months. S65 has the highest variability, which occurs during months with high frequencies of zero flow (June, July, October, November, and December).

The existing intra- and inter-annual distribution of mean monthly flows is the result of current water control schedules. The operation schedule at S65 is designed to remove water from the headwater lakes between February and June 1 in preparation for wet season rainfall. Lakes are allowed to fill to their maximum flood control elevation from June to November through February, when the cycle begins again.

Reference Condition: Reference conditions were derived from daily discharge data from historical gauges at the

outlet of Lake Kissimmee (near existing location of S65) and near Lake Okeechobee (near existing location of S65E) from 1933 to 1960.

Historic mean monthly flows (Figure 2a) were highest during September through November and lower from January through June. The inter-annual variation in historic monthly flows (Figure 2b) indicates minimal differences between months, with the largest variations occurring in June at S65E.

Figure 2 includes estimated historic data at the existing location of S65C (S65C(est)), which represents reference conditions for the lower portion of the first phase of restoration. These data were estimated from historic daily discharge at the outlet of the Kissimmee River basin (S65E) and the ratio of drainage basin areas associated with this location and S65C.

Mechanism for Achieving Expectation:

A new regulation schedule and operation rules were developed to modify headwater inflows through the S65 structure. The new schedule will provide flows that reflect climatic inputs to the upper basin and will result in a more natural, seasonally variable flow regime.

Restoration of the physical form of the river, through backfilling C38 and carving new river segments, will direct flows through the Kissimmee River channel.

Adjustment for External Constraints:

None

Means of Evaluation:

Reestablishment of the annual distribution and year to year variability of mean monthly flows will be evaluated by comparing post restoration data with historic data (Figure 2). Monthly mean flows will be calculated from daily discharge data at S65 and PC33. Statistical analyses will determine any differences in mean monthly flows and variances between post restoration and reference conditions data using a significance level of 0.05. Hypotheses testing will begin with a minimum of 10 years of data. The data set should include the expected range (0 - 18,000 cfs) and annual distribution of flow conditions for S65.

Seasonal pattern and variability of flow also will be analyzed. Interim graphical evaluations will begin the first year after implementation of the S65 regulation schedule to qualitatively assess restoration of the seasonal pattern of mean monthly flows (i.e., annual low flows occur between April and June, annual high flows occur in October, and mean monthly flows show an increase from June to October followed by a decrease from October to January).

Time Course:

Redistribution of monthly flow regimes will be initiated with the implementation of the new regulation schedule, backfilling of C38, and recarving of new river sections.

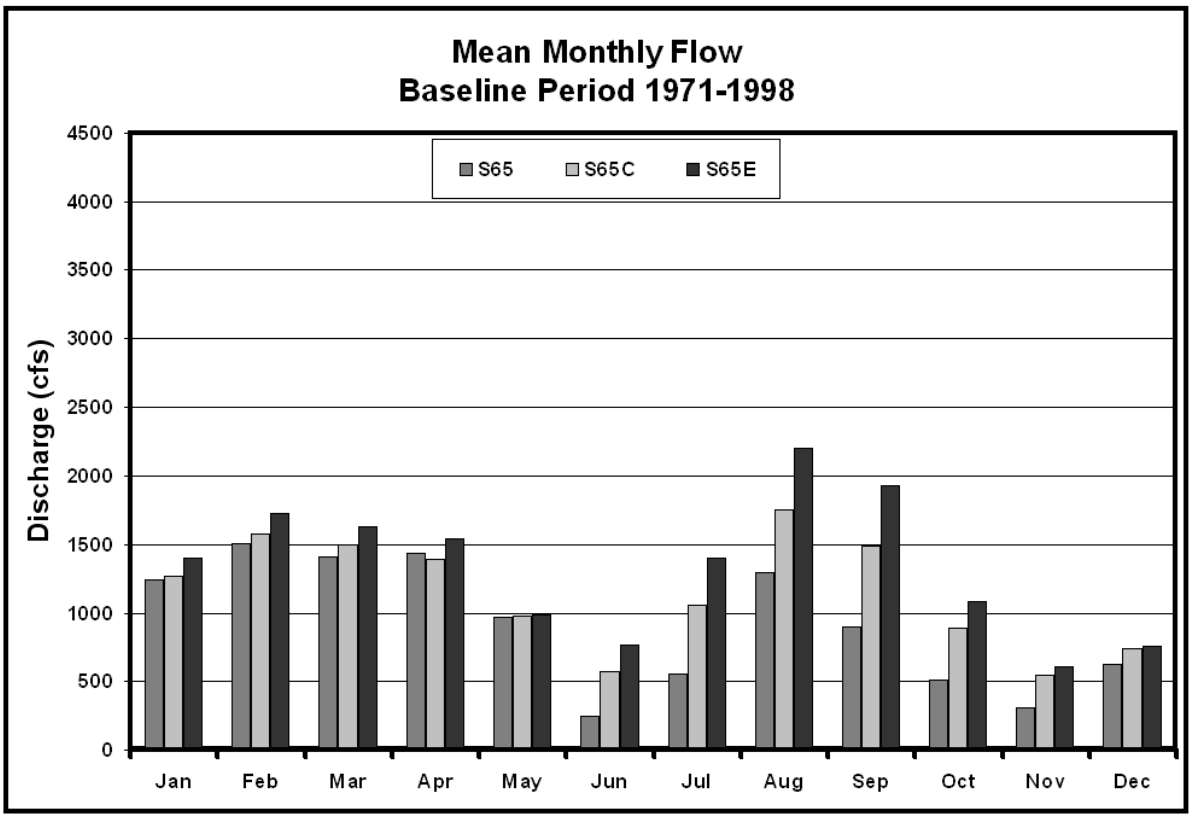

Figure 1a. Baseline mean monthly flows along the channelized Kissimmee River.

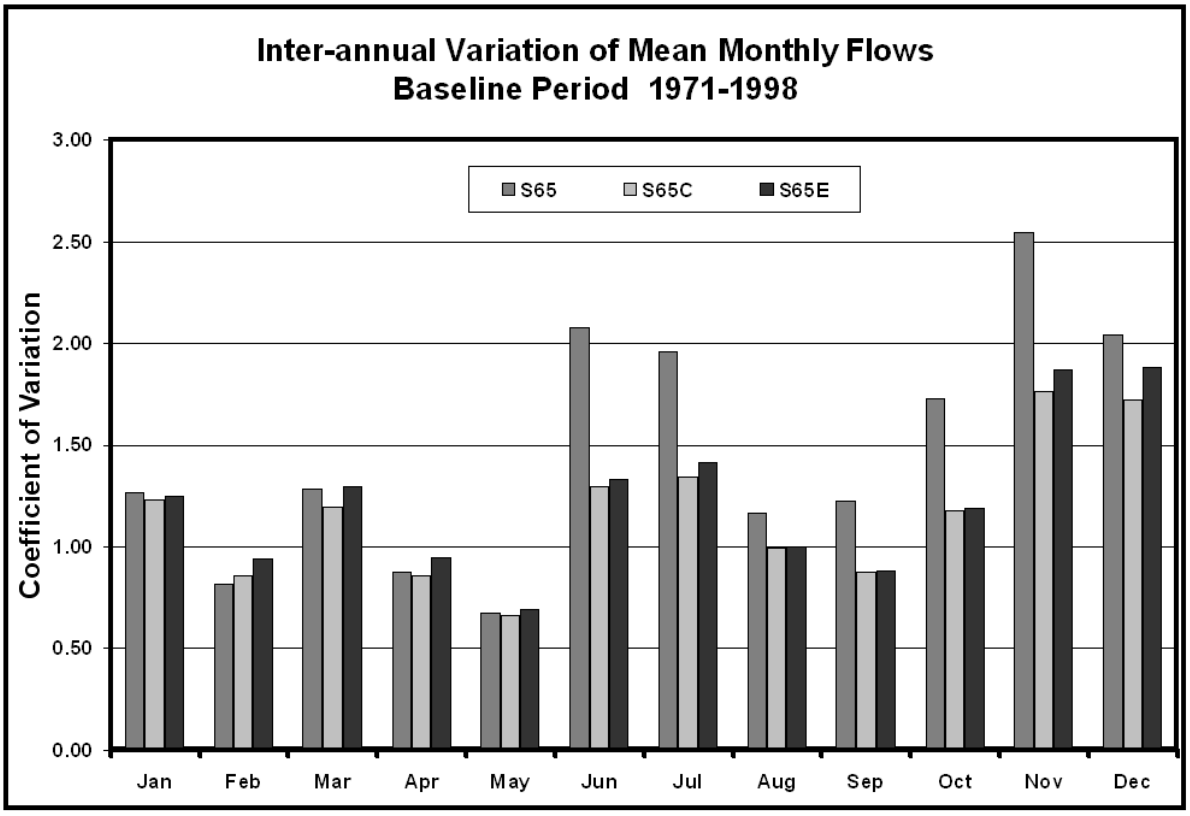

Figure 1b. Baseline year to year variation of mean monthly flows along the channelized Kissimmee River.

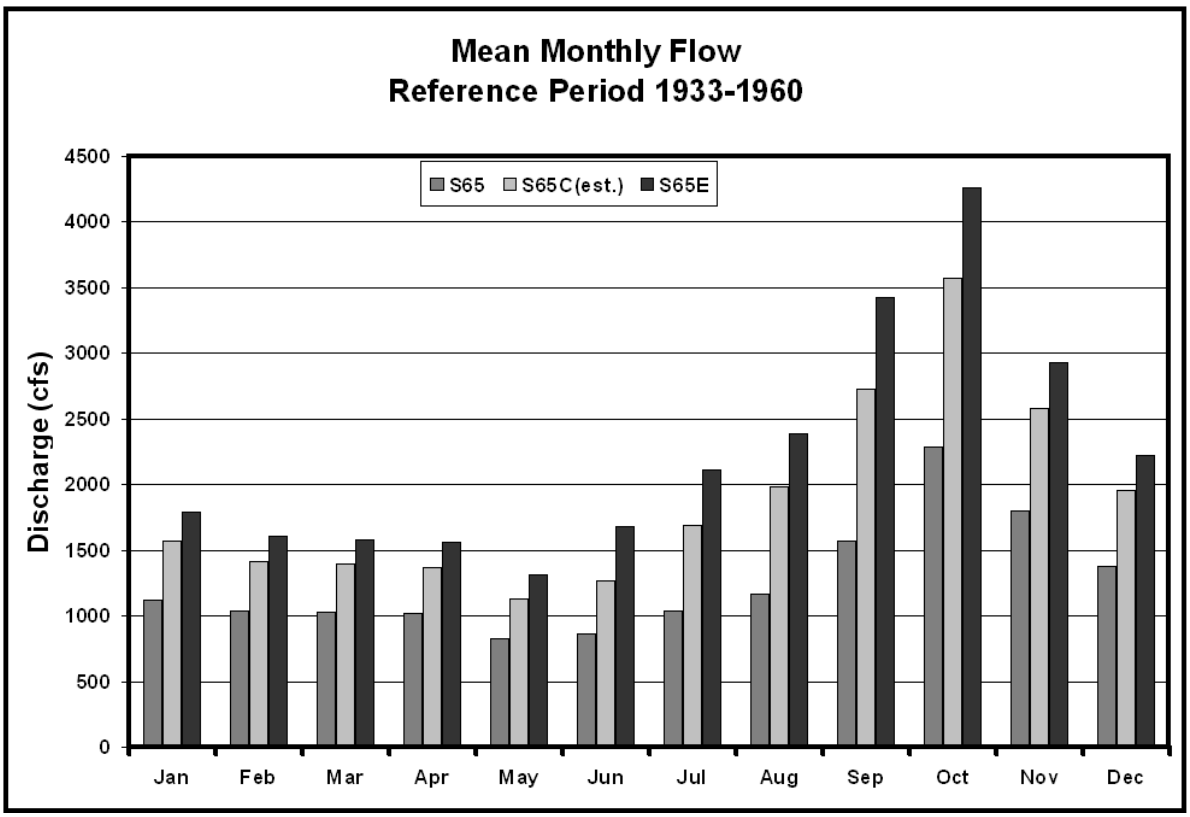

Figure 2a. Historic mean monthly flows along the Kissimmee River. S65C(est.) represents estimated flow conditions for the lower portion of the first phase of restoration.

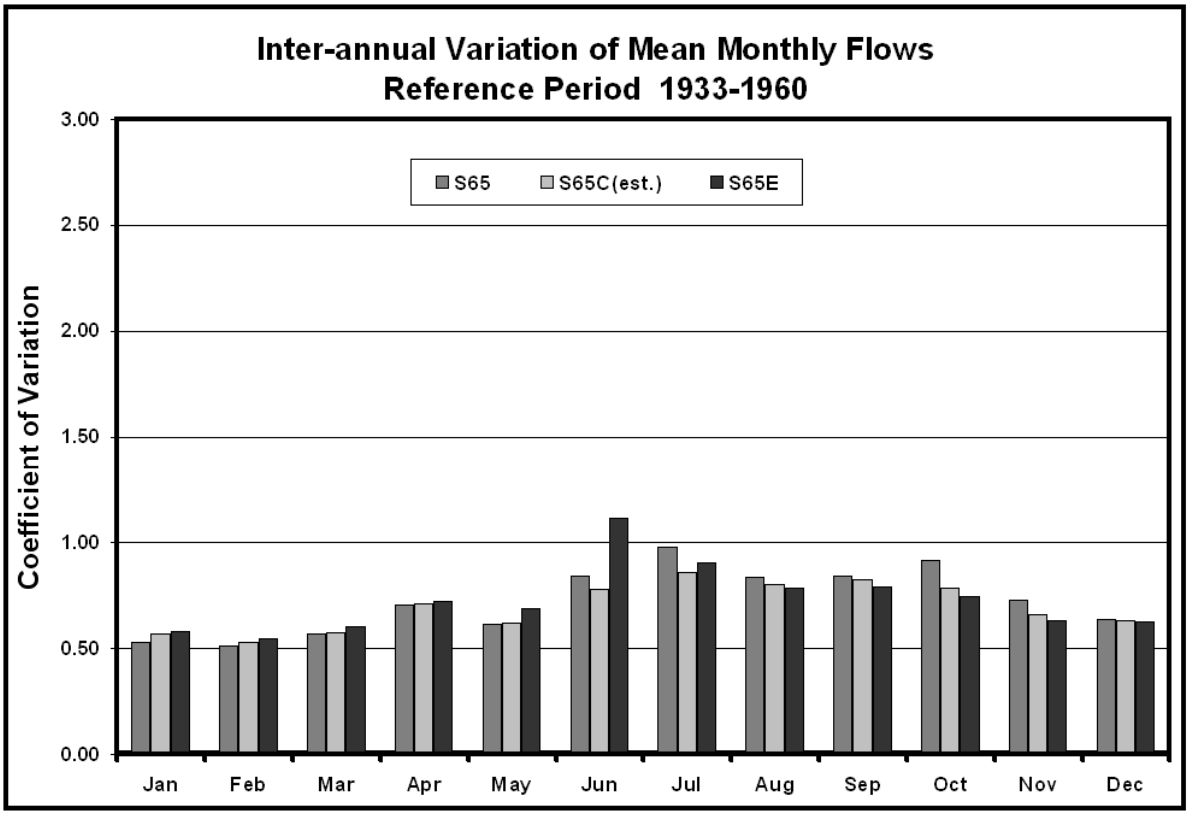

Figure 2b. Historic year to year variation of mean monthly flows along the Kissimmee River. S65C(est.) represents estimated flow conditions for the lower portion of the first phase of restoration.